**K-Spice Generic Oil and Gas Model**

**Tasks to be developed during the simulation session**

# Familiarization

1. Open the “K-Spice SimExplorer”, select “OG-Production” for the “Project”, and “Runtime” for “run application”, then press “start”. Wait until all the messages have appeared (Do not close the extra windows).
2. In this section, you will go through three main systems of the process. Find the relevant equipment from the section, and fill in the material balance inTable 1‑1.

Table 1‑1: System familiarization and material balance

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **System** | **HP separator** | | **Export gas compressor** | | **Export oil pump** | |
| Equipment tag |  | |  | |  | |
| Inlet mole fractions  (**Gas**, **Water, Oil**) | G% |  | G% | G% |  | G% |
| W% |  | W% | W% |  | W% |
| O% |  | O% | O% |  | O% |
| Inlet flow rate [kg/h] |  | |  | |  | |
| Inlet temperature [ºC] |  | |  | |  | |
| Inlet pressure [barg] |  | |  | |  | |
| Outlet pressure [barg] | - | |  | |  | |
| Energy consumption [MW] | - | |  | |  | |

1. Start the model (Play button)
2. Open the costumed trends to check the relevant variables.
3. Set trend time to 10 min for all the trend panels.
4. Increase simulation speed to 5·real time.
5. Let the simulator run for 8 min approx. (simulation time) and then pause it.
6. Fill in the first column of Table 1‑2.

Table 1‑2: Comparison of scenarios

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Unit** | **Normal production**  **(Familiarization)** | **Increased production**  **(Scenario 1)** | **Failure level**  **(Scenario 2)** |
| HP separator max inlet flow rate | m3/h |  |  |  |
| HP separator max level | % |  |  |  |
| HP separator max pressure | barg |  |  |  |
| Gas export steady state | m3/h |  |  |  |
| Oil export steady state | m3/h |  |  |  |
| Gas export compressor max power | MW |  |  |  |
| Oil export pump max power | MW |  |  |  |
| HP flare max flow rate | m3/h |  |  |  |
| ESD-PSD activated? | Yes/No |  |  |  |

# Simulation Scenarios

* The goal of the session is to complete all the simulation scenarios and to collect the results from each of the tasks developed **i.e. fill in Table 1‑2 after Scenario 1 and 2, and copy all the necessary trends for all three scenarios.**
* Work in groups of two participants for Scenarios 1 and 2; discuss with each other how to solve the tasks.

## Scenario 1: Increase production – Choke valve

In this scenario, you are going to make changes in the oil production. The aim of the task is to observe and analyze the effect of this change on the system. Carry out the following procedure in order to complete the task.

1. Load the O&G-model parameters.
2. Start the model (Play button)
3. Open the costumed trends to check the relevant variables and open the ESD/PSD panel.
4. Set trend time to 30 min for all the trends.
5. Increase simulation speed to 5·real time.
6. Let the simulator run for 2 min approx. (simulation time).
7. Make a change in the system: let a choke valve be totally opened, change the output (OP) of the valve controller (13HV0807\_hc) to 100%.
8. Monitor the responses from the custom trends until a new steady state is achieved by the important flowrates (Approx. 20 min simulation time, **after** you make the change) and pause the simulation.
9. Based on the responses shown in the custom trends **fill in the second column of Table 1‑2, write the values that reflect the consequence of the change made**.
10. Paste the trends studied in the empty boxes bellow and write a short analysis of what you saw in this scenario.

Write here your analysis of the scenario.

Figure 2‑1: Change in the stem position of the choke valve 13HV0807, from 75% to 100%

Paste figure here.

Paste figure here.

Figure 2‑2: Level and pressure in the HP-separator

Paste figure here.

Figure 2‑3: Important flowrates

Paste figure here.

Figure 2‑4: Power consumption

## Scenario 2: Failure in Level Controller – HP Separator

In this section, you are going to make some changes in the level controller of the HP separator. The aim of the task is to observe and analyze the effect this change has on the system. Carry out the following procedure in order to complete the task.

1. Reload the O&G-model parameters (so you start with the original system).
2. Start the model (Play button).
3. Open the costumed trends to check the relevant variables and open the ESD/PSD panel.
4. Set trend time to 30 min.
5. Increase simulation speed to 5·real time.
6. Let the simulator run for 2 min (simulation time).
7. Make a change in the system: set the level controller (20LC1015) to manual mode and change the output (OP) to 40%.
8. Monitor the responses from the custom trends until a new steady state is achieved by the important flowrates (Approx. 15 min simulation time, **after** you make the change) and pause the simulation.
9. Based on the responses shown in the custom trends **fill in the third column of Table 1‑2, write the values that reflect the consequence of the change made**.
10. Paste the trends studied in the empty boxes bellow and write a short analysis of what you saw in this scenario.

Write here your analysis of the scenario.

Paste figure here.

Figure 2‑5: Change in the OP of the level controller of the HP-Separator

Paste figure here.

Figure 2‑6: ESD-PSD panel

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Figure 2‑7: Level and pressure in the HP-separator

Paste figure here.

Figure 2‑8: Important flowrates

Paste figure here.

Figure 2‑9: Power consumption

## Scenario 3: Blind scenario – Find and fix the failure

In this section, you are going to run a simulation exercise. The aim of the task is to observe the system and detect, while working individually, if something is not working properly. If you find out that something is not correct in the system, try to localize and fix the problem accordingly. Carry out the following procedure in order to start the exercise:

1. From the Graphics folder, under the category “OverviewGraphics”, find and open the graphic called “Performance\_Assessment”. The values shown in this graphic are meant to guide you through the blind scenario.
2. It can also be useful to open the costumed trends you used for the previous scenarios.
3. Open the Exercise Manager and open the exercise called “Blind\_Scenario”, minimize the Exercise Manager window and go back to K-Spice SimEplorer. Once the exercise is opened, the clock in the K-Spice SimExplorer should automatically reset to zero.
4. Start the simulation and be very attentive to relevant changes in the system. **Restrict the simulation to real time**, this way it will easier for you identify and solve any problem in the system.
5. When you are finished with the scenario, pause the simulation a take a print screen of the Performance\_Assessment graphic, make sure to capture the simulation time in the picture as well, paste it the empty box bellow and write a short analysis of what you saw in this scenario.

Write here your analysis of the scenario.

Print screen of the Performance\_Assessment graphic. Capture the simulation time in the picture.

Figure 2‑10: Performance\_Assessment graphic with the simulation time.